



LECTURE 4

AIRPORT ENGINEERING

AIRPORT ENGINEERING

- Airport Engineering encompasses the planning, design, and construction of terminals, runways, and navigation aids to provide for passenger and freight service.
- Airport engineers design and construct airports. They must account for the impacts and demands of aircraft in their design of airport facilities.
- These engineers must use the analysis of predominant wind direction to determine runway orientation, determine the size of runway border and safety areas, different wing tip to wing tip clearances for all gates and must designate the clear zones in the entire port.

WHAT IS AN AIRPORT?

- An airport is a facility where passengers connect from ground transportation to air transportation.
- It is a location where aircraft such as airplanes, helicopters take off and land.
- Aircraft may also be stored or maintained at an airport.
- An airport should have runway for takeoffs and landings, buildings such as hangars and terminal buildings.

AIRFIELD

- Airfield is an area where an aircraft can land and take off, which may or may not be equipped with any navigational aids or markings.
- Many grass strips are also designated as airfields.



WHAT ARE AERODROMES?

- A defined area on land or water (including any buildings, installations and equipment) intended to be used either wholly or in part for the arrival, departure and surface movement of aircraft.



AIRCRAFT CHARACTERISTICS

- **The size;**
 - **Span of wings:** This decides the width of taxiway, size of aprons and hangers.
 - **Height:** This decides the height of hanger gate and miscellaneous installations inside the hanger.
 - **Wheel base:** This decides minimum taxiway radius.
 - **Tail width:** Required for size of parking and apron.
- **Minimum turning radius:** To determine the radii at the ends of the taxiways and to ascertain the position on the loading apron.

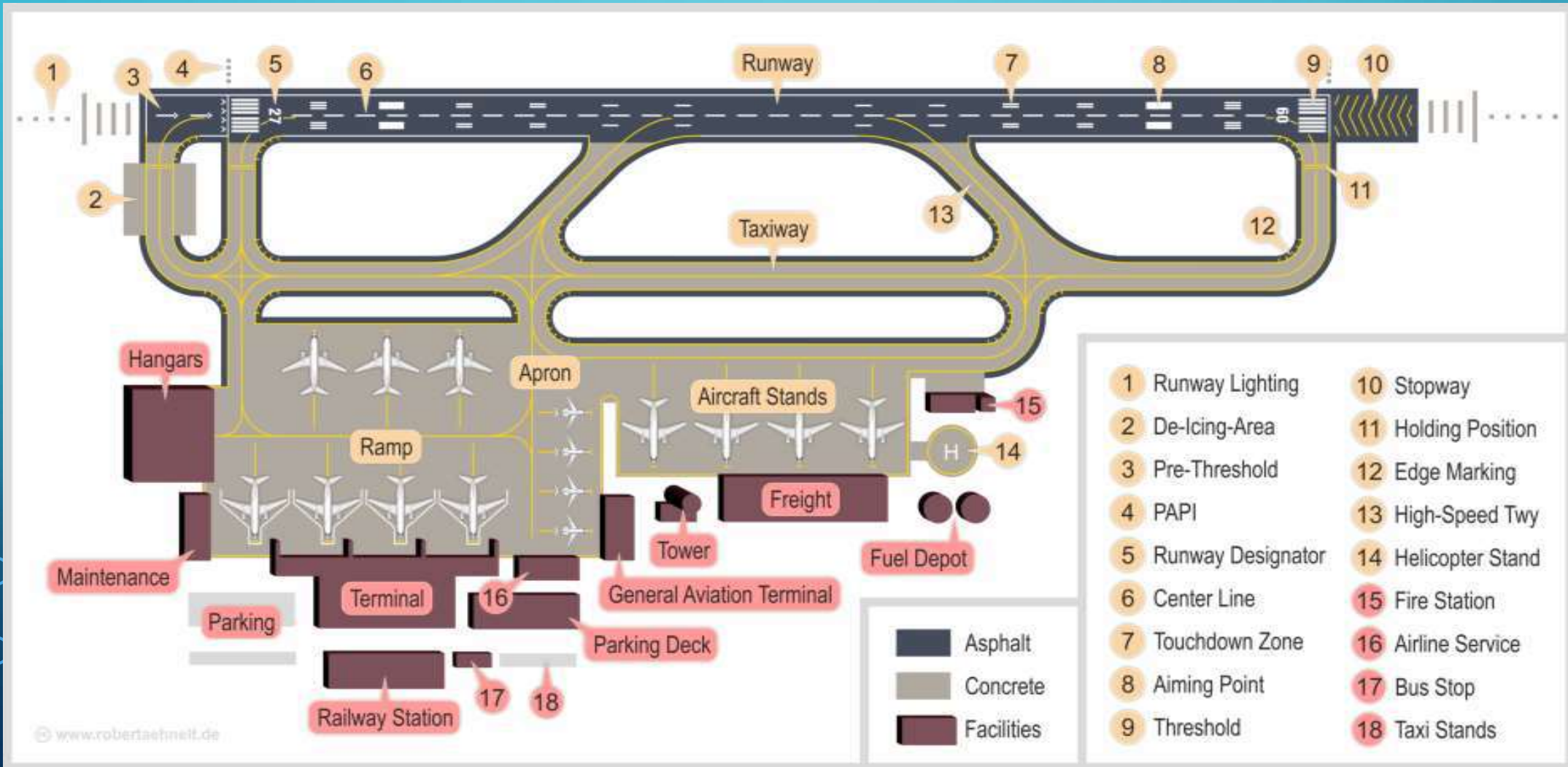
AIRCRAFT CHARACTERISTICS

- **Take-off and landing distances:** A number of factors such as altitude of the airport, gradient of runway, direction and intensity of wind, temperature and the manner of landing and take-off which influence the take-off and landing distances.
- **Tyre pressure and contact area:** It governs the thickness of the pavement.

FACTORS AFFECTING SELECTION OF SITE FOR AIRPORT:

- Availability of adequate area
- Accessibility
- Topography, soil condition and drainage
- Availability of construction materials
- Cost of development
- Cost of maintenance
- Traffic volume and type of traffic
- Cross-wind component
- Proximity of airways
- Safety factors
- Revenues

TYPICAL LAYOUT OF AN AIRPORT



IMPORTANT COMPONENTS OF AN AIRPORT LAYOUT

1. Runway
2. Terminal Building
3. Apron
4. Taxiway
5. Aircraft Stand
6. Hangar
7. Control Tower
8. Parking

1. RUNWAYS

- A runway is the area where an aircraft lands or takes off. It can be grass, or packed dirt, or a hard surface such as asphalt or concrete. Runways have special markings on them to help a pilot in the air to tell that it is a runway (and not a road) and to help them when they are landing or taking off. Runway markings are white.
- Most runways have numbers on the end. The number is the runway's compass direction. (For example, runway numbered 36 would be pointing north or 360 degrees). Some airports have more than one runway going in the same direction, so they add letters to the end of the number R for right, C for center, and L for left.

1. RUNWAYS



2. TERMINAL BUILDINGS

- Also known as airport terminal, these buildings are the spaces where passengers board or alight from flights. These buildings house all the necessary facilities for passengers to check-in their luggage, clear the customs and have lounges to wait before disembarking. The terminals can house cafes, lounges and bars to serve as waiting areas for passengers.
- Ticket counters, luggage check-in or transfer, security checks and customs are the basics of all airport terminals. Large airports can have more than one terminal that are connected to one another through link ways such as walkways, sky-bridges or trams. Smaller airports usually have only one terminal that houses all the required facilities.

3. APRONS

- Aircraft aprons are the areas where the aircraft park. Aprons are also sometimes called ramps.
- They vary in size, from areas that may hold five or ten small planes, to the very large areas that the major airports have.

3. APRONS

No Planes, Buildings or Vehicles Included



4. TAXIWAY

- A taxiway is a path on an airport connecting runways with ramps, hangars, terminals and other facilities.
- They mostly have hard surface such as asphalt or concrete, although smaller airports sometimes use gravel or grass.

5. AIRCRAFT STAND

- A portion of an apron designated as a taxiway and intended to provide access to aircraft stands only.



6. HANGAR

- A hangar is a closed building structure to hold aircraft or spacecraft. Hangars are built of metal, wood, or concrete.
- Hangars are used for protection from the weather, direct sunlight and for maintenance, repair, manufacture, assembly and storage of aircraft.



7. CONTROL TOWER

- A tower at an airfield from which air traffic is controlled by radio and observed physically and by radar.



8. PARKING

- Parking is a specific area of airport at which vehicles park.









RUNWAY ORIENTATION & DESIGN

- Runway is defined as the “Rectangular area on an aerodrome used for landing and take off “
- Runway orientation is important in airport planning
- Current practice is to layout a runway in the direction of prevailing wind.

IMPORTANCE OF RUNWAY LAYOUT

- Determination of runway is a critical task
- It is very important for safe take offs and approaches
- The width and sloping of runway also play a role in safe approaches . It can be illustrated by the figure

IMPORTANCE OF RUNWAY LAYOUT

Downsloping runway.	Level runway.	Upsloping runway.
 <p data-bbox="529 635 657 664">Day</p> <p data-bbox="402 963 810 1092">Pilot incorrectly perceives approach is low.</p>  <p data-bbox="496 1256 726 1285">Night</p>	 <p data-bbox="1184 635 1312 664">Day</p> <p data-bbox="1057 949 1465 1092">Pilot correctly perceives approach is accurate.</p>  <p data-bbox="1159 1256 1388 1285">Night</p>	 <p data-bbox="1854 635 1982 664">Day</p> <p data-bbox="1727 949 2135 1092">Pilot incorrectly perceives approach is high.</p>  <p data-bbox="1821 1256 2051 1285">Night</p>

RUNWAY NUMBERS

- Runways are numbered according to the magnetic compass direction they are oriented to.
- Consists of two numbers one at each end of runway
- Preceding that number are eight stripes.
- Runway numbers are not given in degrees, rather in shorthand format e.g. a runway with a marking of 14 is actually 140 degrees
- For simplicity FAA rounds off the precise headings to nearest tens.

RUNWAY CONFIGURATION

- FAA includes over 20 runway layouts
- Amongst them there are 4 basic runway patterns :

1. SINGLE RUNWAY

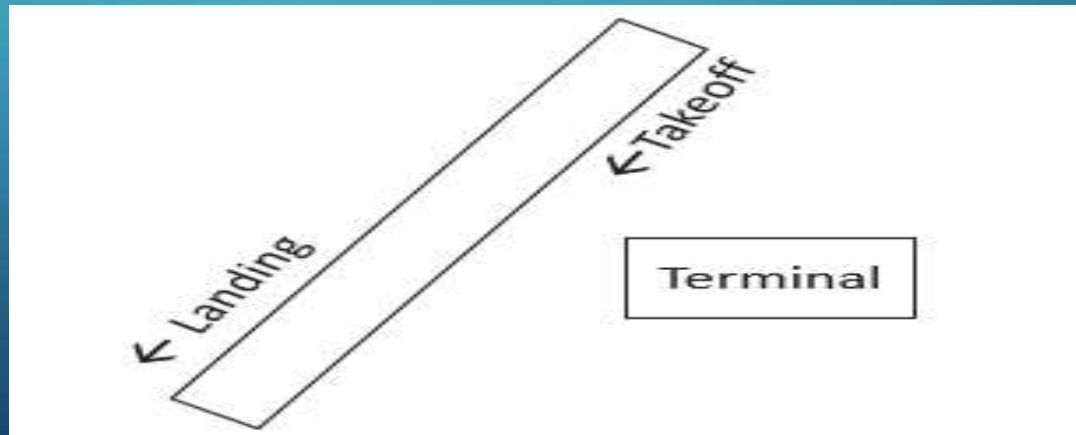
2. INTERSECTING RUNWAY

3. PARALLEL RUNWAY

4. OPEN-V RUNWAY

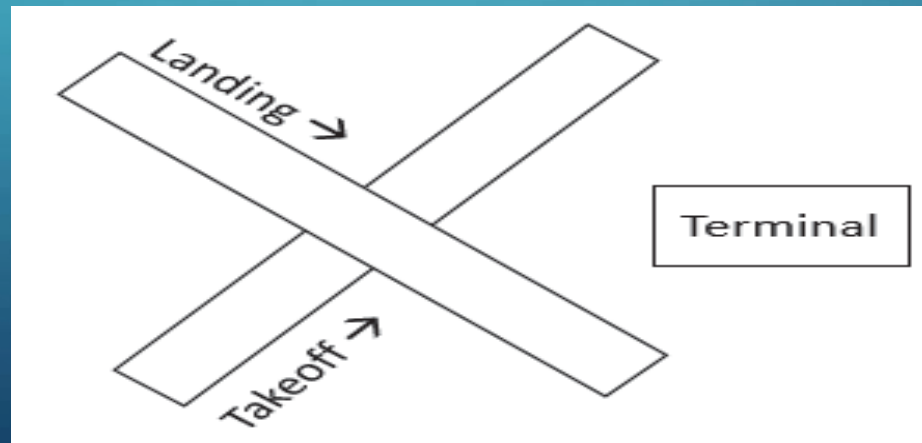
1. SINGLE RUNWAY

- Single runways consist of one lone runway that accommodates both takeoffs and landings.
- The configuration is often seen in small regional airports that do not have heavy amounts of air traffic. Single runways can handle up to 100 flights per hour in ideal conditions, both inbound and outbound.



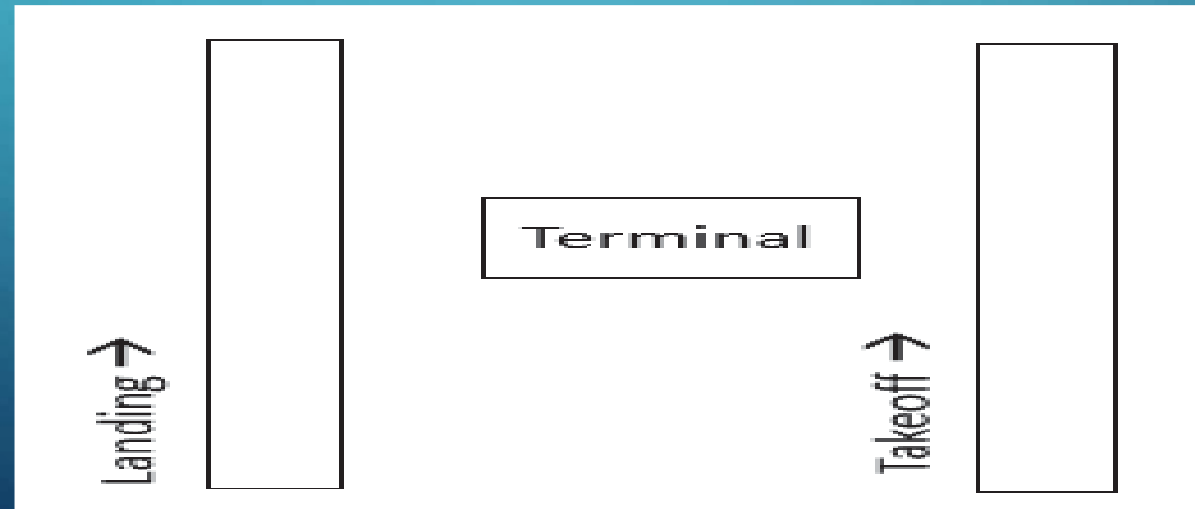
2. INTERSECTING RUNWAY

- Intersecting runways consist of two or more runways that cross paths and share ground with one another.
- These runways are often used in locations with strong winds and/or limited expansion space. When wind speeds are not favorable for arriving and departing aircraft, one of the intersecting runways will go unused.



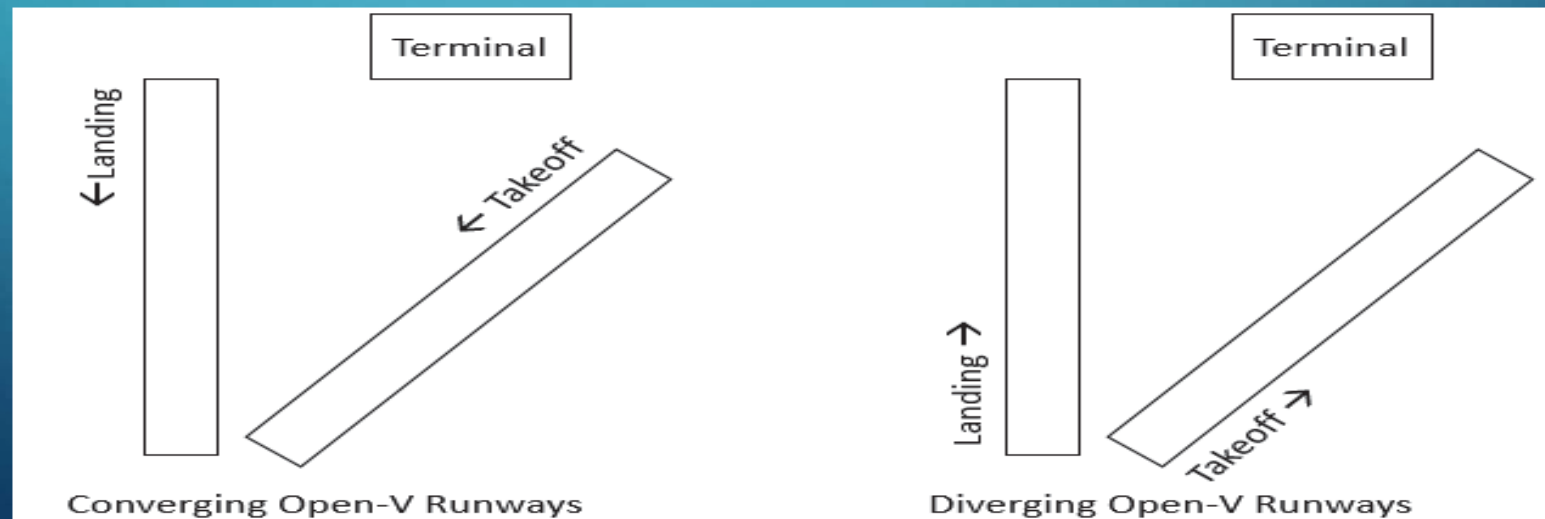
3. PARALLEL RUNWAY

- Parallel runways are defined as those in which more than one runway is present and situated at the same angle. A basic parallel runway configuration can be seen in figure. The capacity of parallel runways depends on the number of runways in parallel and the spacing between them.



4. OPEN-V RUNWAY

- Open-V runways are those that are oriented in different directions that do not intersect.
- If wind speeds were strong enough in one direction, the runway unfavorable to the prevailing wind would be inoperable. The remaining runway would act as if were at a single runway airport.



RUNWAY LIGHTING

- These lights are used to assist pilot in to identify the runway
- GREEN THRESHOLD LIGHTS : Line the runway edge
- RED LIGHTS : Mark the end of runway
- BLUE LIGHTS : Run alongside taxiways
- While runways have YELLOW or WHITE lights marking their edges

